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EVALUATION OF ENHANCEMENT EFFORTS FOR THE SPORT FISHERY FOR RAINBOW TROUT IN BIG LAKE, ALASKA, 1988[1]

By

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ABSTRACT

Twenty-four thousand thirty-three marked hatchery rainbow trout *Oncorhynchus mykiss*, mean fork length 176 millimeters, were released into Big Lake on 1 June 1988. Fish populations in Big Lake were sampled in June and October of 1988 with fyke nets and gill nets for the purpose of estimating the abundance of the wild population. The two estimates of abundance at time of release differed, 10,607 wild trout were estimated in June and 22,261 in October. This difference was possibly due to incomplete mixing of marked fish within the lake during the June sampling.

KEY WORDS: Southcentral Alaska, Matanuska-Susitna Valley, Big Lake, net sampling, population estimate, rainbow trout, *Oncorhynchus mykiss*, Arctic char, *Salvelinus alpinus*.

INTRODUCTION

Big Lake is located in the Matanuska-Susitna Valley of southcentral Alaska (Figures 1 and 2). Meadow Creek, the principal tributary of Big Lake, drains an extensive watershed that includes over 30 lakes and ponds located north and east of the lake. Minor drainages also enter from the west through Flat and Mirror (Mud) Lakes. Fish Creek, the outlet of Big Lake, flows approximately 23 km into the Knik Arm of northern Cook Inlet.

Many private residences and easy public access along the lake have contributed to the growth and popularity of a recreational fishery in Big Lake. Currently, there are 934 lake front lots with more than 500 private lake front cabins and residences, two state waysides, a private commercial campground, two boat marinas, and at least seven lounge and restaurant establishments including three motel/lodges.

During 1952, the U.S. Fish and Wildlife Service studied fishing pressure on Big Lake. These studies indicated that 10.9% of all sport fishing on the Alaska mainland south of the Alaska Range occurred on Big Lake (Allin 1956). During the period 1977 to 1987, fishing effort on Big Lake has averaged approximately 13,537 angler-days annually (Mills 1979-1988). Big Lake is the largest producer of nonanadromous Dolly Varden/Arctic char[1] *Salvelinus sp.* in Alaska, has the largest ice-fishery for Arctic char, and in 1987 had the largest single-system harvest of Arctic char statewide (Mills 1988). Big Lake also had the second highest reported single-system harvest of native rainbow trout *Oncorhynchus mykiss* in 1987 (Mills 1988). The lake is also the site of an Alaska Department of Fish and Game (ADF&G) hatchery. In 1988, this hatchery released 14,500,000 sockeye salmon *O. nerka* fry and 1,920,000 coho salmon *O. kisutch* fingerling and smolt into the Big Lake drainage.

Pronounced reductions in catch rate and harvest for both rainbow trout and Arctic char during 1983 and 1984 (Table 1) provided the impetus for this investigation. Although both rainbow trout and Arctic char harvest and catch per unit of effort (CPUE) showed improvement in 1985 and 1986, reported rainbow trout harvest and CPUE decreased dramatically in 1987. The development of management strategies and regulatory measures to achieve optimum sustained recreational yield for these species remains a goal.

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[1] Gill raker and pyloric caeca counts (Appendix Table 1) indicate that these fish are Arctic char *Salvelinus alpinus* rather than Dolly Varden char *Salvelinus malma*, but are reported as Dolly Varden/Arctic char in Mills (1979-1988).

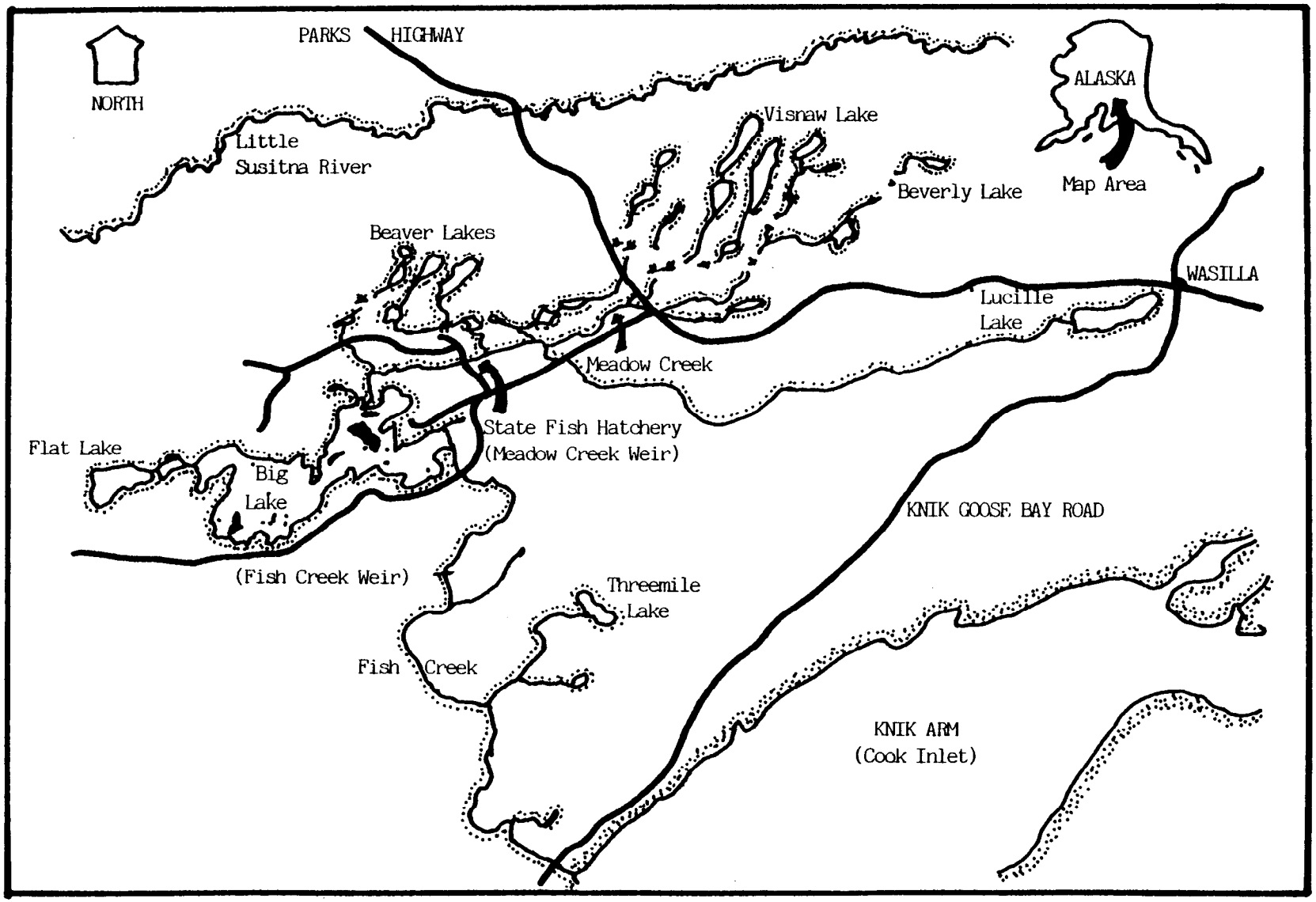

Figure 1. Study area of the Matanuska-Susitna Valley.

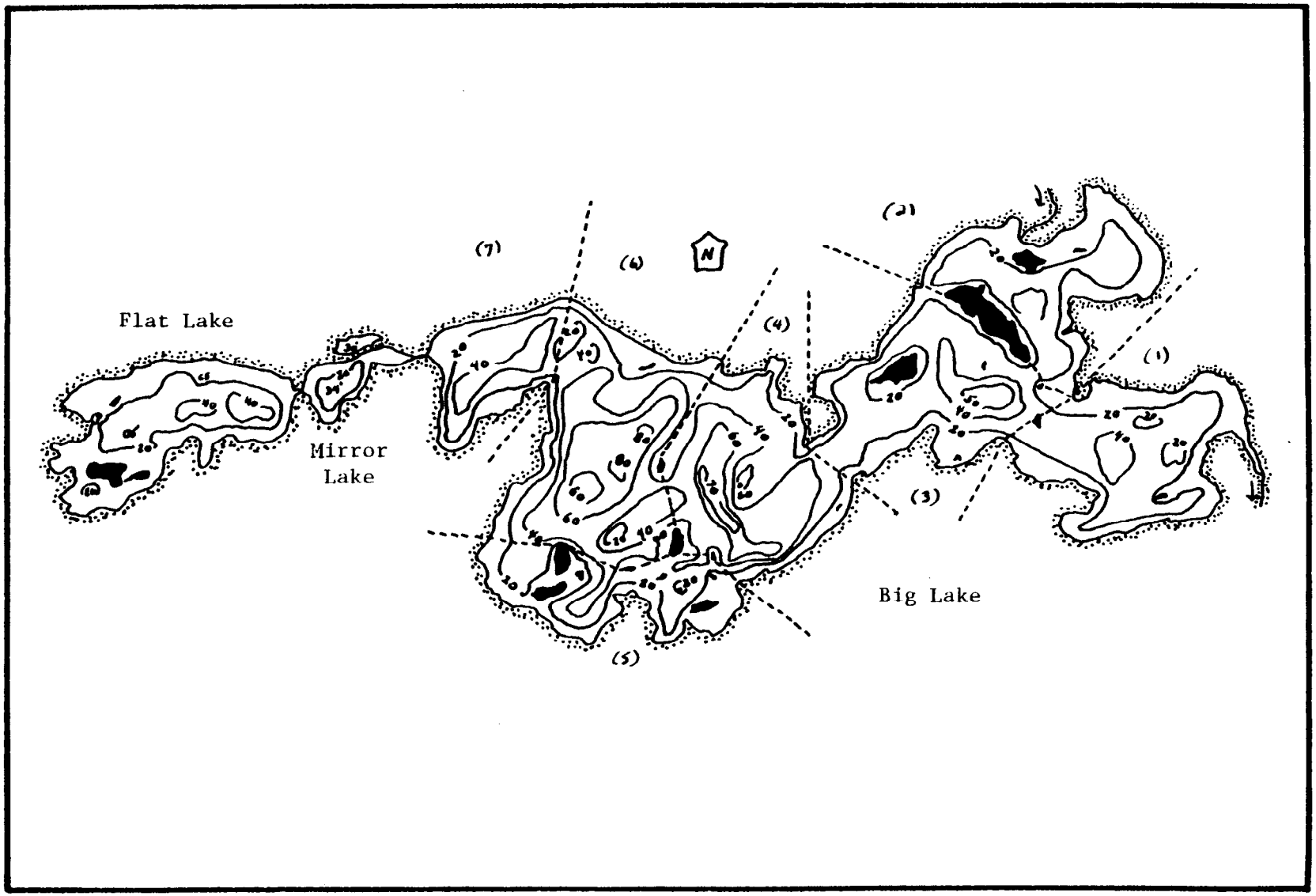

Figure 2. Big Lake contour map partitioned to indicate seven sampling basins, and interconnected Mirror Lake and Flat Lake.

Table 1. Sport effort, harvest, and catch per unit effort (CPUE) for rainbow trout, Arctic char, and juvenile coho salmon at Big Lake, 1977-1987[1].

Year	Effort (angler-days)	Rainbow Trout		Arctic Char[2]		Coho Salmon[3]		Composition		
		Harvest	CPUE	Harvest	CPUE	Harvest	CPUE	RT	Char	SS
1977	11,869	3,906	0.329	5,618	0.417	721	0.061	38%	55%	7%
1978	9,865	4,845	0.491	5,433	0.551	226	0.023	46%	52%	2%
1979	8,300	2,882	0.347	4,682	0.564	145	0.017	37%	61%	2%
1980	12,195	5,398	0.443	8,179	0.671	189	0.016	39%	60%	1%
1981	14,568	9,810	0.673	8,364	0.574	651	0.045	52%	44%	4%
1982	15,371	9,369	0.610	9,233	0.601	324	0.021	49%	49%	2%
1983	15,989	4,102	0.257	6,567	0.411	462	0.029	37%	59%	4%
1984	12,196	4,938	0.405	4,664	0.382	1,384	0.113	45%	42%	13%
1985	16,299	6,953	0.427	8,252	0.506	703	0.043	44%	52%	4%
1986	14,559	5,105	0.351	7,406	0.509	618	0.042	39%	56%	5%
1987	17,693	2,476	0.140	8,638	0.488	1,322	0.075	20%	69%	11%
1988[4]	10,077	4,220	0.419	5,930	0.535	1,655	0.164	36%	50%	14%
Average	13,248	5,334	0.403	6,914	0.523	700	0.053	41%	54%	5%

[1] Source: Mills (1979-1988).

[2] Includes fish reported as Arctic Char, Dolly Varden, and lake trout; no lake trout have been recorded by Fish and Game personnel.

[3] Coho salmon juveniles are recorded as landlocked salmon in the Statewide Harvest Survey.

[4] Preliminary estimates from the Statewide Harvest Survey.

METHODS

During 1988, rainbow trout were stocked into Big lake for the first time[2]. These fish were marked prior to stocking and were an integral part of a mark-recapture experiment to estimate the abundance of wild rainbow trout in Big Lake. The contribution of stocked and wild fish in the sport harvest were estimated through examination of the sport harvest. Many of the inter-connected lakes were sampled to detect the occurrence of rainbow trout in other basins in the Big Lake drainage.

Rainbow Trout Sampling

Big Lake strain rainbow trout from the Alaska Department of Fish and Game Fort Richardson Hatchery were planted in Big Lake on 1 June 1988. A total of 24,033 rainbow trout, ranging from 98 mm to 268 mm and averaging 176 mm, were marked at the hatchery. Marking and stocking were accomplished as follows: 8,022 left ventral finclipped trout were stocked at the northeast end of Big Lake; 8,008 adipose finclipped trout from the southcentral shoreline; and 8,003 right ventral finclipped trout at the west end of Big Lake. Fish were subsequently sampled in the lake twice, in June and in October.

Rainbow trout were sampled during June using fyke and gill nets, and in October using fyke nets. Fyke nets were 2.7 m (9.0 ft) in length by 76.2 cm (30.0 in) in diameter and included two 0.9 m (3.0 ft) by 6.1 m (20.0 ft) wings (two square aluminum frames and six steel or aluminum hoops supported the entrance and body of the fyke net). Internal throats, body, and wings were of 0.5 cm (0.2 in) square mesh knotless nylon. Gill nets were 36.6 m (120.0 ft) by 1.8 m (6.0 ft) variable mesh monofilament composed of six square mesh sizes: 1.3 cm (0.5 in), 1.6 cm (0.6 in), 1.9 cm (0.8 in), 2.5 cm (1.0 in), 3.8 cm (1.5 in), and 5.1 cm (2.0 in) each in a 6.1 m (20.0 ft) panel.

Big Lake basins 1 through 7 and Mirror Lake and Flat Lake (Figure 2) were sampled sequentially during June 1988. Up to 22 randomly selected littoral zone fyke net sites, and up to 15 randomly selected gill net sites were fished in each basin: five sites from the shoreline, five sites from 4.9 m (16.0 ft) to 9.2 m (30.0 ft) deep, and five sites from 9.5 m (31.0 ft) to 13.7 m (45.0 ft) deep or to the bottom. In October, Big Lake basins 1, 4, and 7 were each fished overnight with 17 fyke nets set in random locations along the shoreline.

Beginning 20 June, fyke nets were set to fish overnight while gill nets were set, picked and reset, then pulled between 1800 and 0100 hours. Fish captured by fyke net were placed in a tub oxygenated with a portable 7.5 kg (20 lb) oxygen bottle and anesthetized with equal parts of MS-222 and Quinate. Rainbow trout captured by fyke nets were tallied by finclip, measured for fork length to the nearest millimeter, marked with an upper caudal clip, and released. Fish captured by gill net were tallied by species and finclip (rainbow trout), and measured. Mortalities were high in the gill

[2] Rainbow trout of Big Lake origin provide fish for Alaska's landlocked lake stocking program.

net sampling and few fish were released. All mortalities of wild rainbow trout and Arctic char were sampled for an otolith to estimate the length/age relationship. Rainbow trout to be released from gill nets were marked with a lower caudal clip. Data collected from all rainbow trout and Arctic char were recorded by capture location and gear type. All rainbow trout captured by fyke net during the October 1988 sampling were tallied by finclip, measured for fork length to the nearest millimeter, and released.

Abundance Estimators

The abundance of rainbow trout was estimated in Big Lake using mark-recapture estimators for closed populations: the Chapman modification of the Petersen estimator (Seber 1982) and the stratified Petersen estimator (Darroch 1965, Seber 1982). Two estimates of abundance at the time of release could be made, one using recaptures made in June and the second using recaptures in October. Several assumptions of the mark-recapture estimator were tested before the estimation method was chosen for each sampling period.

Petersen Estimator:

The abundance, N, is estimated by:

$$\hat{N} = \frac{(M+1)(R+1)}{(C+1)} - 1 \qquad (1)$$

and the variance by:

$$Var(N) = \frac{(M+1)(C+1)(C-R)(M-R)}{(R+1)^2(R+2)} \qquad (2)$$

where:

M = number of marked trout released,
R = number of recaptures,
C = number of trout examined for recaptures.

The assumptions for this estimate are:

1. there is no recruitment or immigration into the population or emigration out between sampling events,

2. marking does not affect the catchability, i.e. stocked and wild fish have the same catchability,

3. all trout have equal chance of being caught in the recapture sample or marked fish have completely mixed with unmarked fish prior to the recapture sample, and

4. there is no marking mortality and all recaptured fish are reported.

Stratified Petersen Estimator:

As the release of marked fish occurred at three separate locations, the assumption of complete mixture or equal chance of capture for the three groups may not be met. A stratified estimator which allows for geographical stratification and movement between strata can then be used (Darroch 1961). When there are equal numbers of release and recovery strata, the stratified estimator ($\underline{W}$) is (Seber 1982):

$$\underline{W} = D_u M^{-1} \underline{a} \qquad (3)$$

where:

$\underline{W}$ = a vector with the estimates of the number of unmarked rainbow trout in each marking stratum just after the release of the marked fish,

D_u = a diagonal matrix of the number of unmarked fish observed in each recovery stratum j,

M = a matrix of m_{ij}, the number of marked fish in each recovery stratum, j, which were released in marking stratum i, and

$\underline{a}$ = a vector of the number of marked fish released in marking stratum i.

The number of rainbow trout in each stratum at the time of marking is the sum of the estimated number of unmarked fish present and the number of marked fish released in that stratum. The variance-covariance matrix of $\underline{W}$ was estimated using equations 11.20-11.23 on page 441 of Seber (1982). The variance of the point estimate for the total number of rainbow trout present is the sum of the variance and covariance estimates for the individual strata.

Assumptions necessary for the abundance estimates are (Seber 1982):

1. all rainbow trout in the j^{th} recovery stratum, whether marked or unmarked, have the same probability of being caught,

2. marked fish behave independently of one another with regard to moving among strata and being caught,

3. a marked trout is as likely to be caught as an unmarked fish,

4. all marked fish are recognized as such during recovery,

5. there is no marking induced mortality, and

6. there is no emigration, immigration, or recruitment between sampling events.

Gear Selectivity:

Gear selectivity could present a problem in these experiments, particularly since the marked fish were introduced from a hatchery and were not sampled from the lake population. In order to determine whether the gears used were selective with regards to the size of the rainbow trout, non-parametric two-sample Kolmogorov-Smirnov (Conover 1980) and three-sample Anderson-Darling tests (Scholz and Stephens 1987) were used to compare length distributions at time of release and sampling. The original length distributions of each release group were compared to the length distribution of the group sampled in June with gill net and fyke net gear. In addition, the length distributions of the three release groups were compared for each gear type, and between gears for the three release groups and for unmarked trout. Tests with p-values less than 0.10 were considered significant.

Equal Probability of Capture:

Marked fish were released at three separate locations of the lake. An important assumption of the Petersen estimator is that marked fish are completely mixed with the unmarked population, or that all fish have equal probability of capture. This assumption would be met if the separate marked rainbow trout migrate and mix throughout the lake prior to a recapture sample, or if the recovery effort was equally distributed throughout the lake. In order to test this assumption, two comparison were made: the first comparing the rate of recovery of each release group and the second comparing the ratio of marked to unmarked in separate geographical areas of the lake. These comparisons were made using chi-square tests of homogeneity as described by Seber (1987), pages 438-439. If both of these tests were rejected, the stratified Petersen was used for estimating abundance.

Recruitment:

The recovery sample taken in October occurred 4 months after release and the possibility must exist that growth recruitment had occurred in the unmarked or wild population of rainbow trout. In order to detect and eliminate recruits to the sampling gear from the unmarked portion of the sample, a non-parametric procedure described by Robson and Flick (1965) was used. Marked fish are sequentially ordered by their length to become boundaries between cells to which unmarked fish are assigned according to their length. Assuming that sampling gear captures unmarked fish with the same effectiveness as it does marked fish of the same size, the expected number of unmarked fish will be the same for each cell if no growth recruitment had occurred between the time of marking and the time of recapture. This expected number is:

$$V = v / (k+1) \qquad (4)$$

where,

V = expected number of unmarked to marked for each length interval,
v = total number of unmarked rainbow trout,

k = total number of unique lengths of marked rainbow trout,

and the observed average number of unmarked to marked for each length interval (V_i) is,

$$V_i = \frac{1}{k+1-i} \sum_{j=i}^{k} v_j \qquad (5)$$

where,

v_j = number of unmarked in length interval j.

If growth recruitment had occurred into the smaller size groups, then the observed V_i for these groups will be larger than the expected, since there will be a higher number of unmarked trout. If growth recruitment is detected and the size groups identified, these would be culled from the recovery sample and the population estimated only for non-recruited size groups.

Examination of Sport Harvest

Survey personnel identified harvested rainbow trout from the hatchery by finclip, measured rainbow trout and Arctic char for fork length to the nearest millimeter and, with the angler's permission, collected the head of each wild rainbow trout and Arctic char to determine its age through analysis of otoliths. Fish heads were labeled and frozen for later analysis. Sampling was conducted during the open-water season (summer fishery) from June through October 1988, and included 6 weekdays and 4 weekend days in June, 4 weekdays, 4 weekend days, and one holiday in July, 6 weekdays and 5 weekend days in August, 2 weekdays, 4 weekend days, and one holiday in September, and 3 weekdays and 4 weekend days in October.

Ice began forming on Big Lake on 29 October 1988. Winter fishery sampling commenced on 11 November 1988 when anglers started ice-fishing and included 8 weekdays and 6 weekend days in November, 12 weekdays and 6 weekend days in December, 3 weekdays and 4 weekend days each in January and February, and 2 weekend days each in March and April.

Lake Surveys

The following lakes were sampled during July and August of 1988 to detect the occurrence of rainbow trout: Beaver Tail, Dollar, Little Beaver, Never-Never, Orchid, and Sara Lakes. Fish were collected from each lake by use of gill nets, fyke nets, and minnow traps set overnight. At least one gill and fyke net and five minnow traps were set in all lakes surveyed. Minnow traps were semi-collapsible and 44.4 cm (17.5 in) in length with 0.3 cm (0.1 in) square wire mesh painted green and brown and baited with salmon eggs. All fish were counted by capture gear and species. All rainbow trout were measured for fork length to the nearest millimeter, and catch rates were computed for each species by gear type.

RESULTS

Thirteen species of fish were captured in Big Lake and interconnecting Mirror and Flat Lakes during 1988 and included rainbow trout, Arctic char, coho salmon, sockeye salmon, ninespine stickleback, round whitefish *Prosopium cylindraceum*, burbot *Lota lota*, longnose sucker *Catostomus catostomus*, ninespine stickleback *Pungitius pungitius*, slimy sculpin *Cottus cognatus* and prickly sculpin *Cottus asper*. Only rainbow trout and Arctic char catch and length data were recorded.

The average length at release of the hatchery rainbow trout with left ventral finclips was 176 mm (n=300, SE=2) and the average length at release of trout with right ventral and adipose finclips was 175 mm (n=301, SE=1). The length distributions of these two groups were significantly different (Table 2) at release as the left ventrally clipped group had a smaller overall range (Figure 3).

In June, a total of 1,832 rainbow trout (1,313 marked and 519 unmarked) were captured in 172 fyke net sets and of these 1,297 marked and 518 unmarked trout were released (Table 3 and Appendix Table 2). A total of 368 trout (272 marked and 94 unmarked) were captured in 120 gill net sets (Table 3), with 163 released, 41 unmarked and 122 marked. Eleven, or 0.9% of the caudal-clipped stocked trout and 17, or 2.8% of the caudal-clipped wild trout, that were released from fyke and gill nets, were subsequently recaptured prior to the completion of the sampling period on 28 June. In October of 1988, 155 marked and 198 unmarked trout were taken in 51 sets (Table 4). In June, the average length of stocked rainbow trout taken in fyke nets was 174 mm (SE=1) and of unmarked trout 167 mm (SE=1), and in gill nets the marked trout averaged 183 mm (SE=1) and the unmarked 239 mm (SE=6) (Table 5). In October, the marked trout averaged 240 mm (SE=2) and the unmarked trout averaged 233 mm (SE=4) (Table 6). Arctic char captured only by gill net in June averaged 425 mm (Table 5) and the two Arctic char captured in fyke nets averaged 200 mm (Table 6).

Gear Selectivity

Rainbow trout were sampled with fyke nets and gill nets in June of 1988, shortly after release. The mean length of all the groups was larger in the gill nets compared to the fyke net in June (Table 4). Kolmogorov-Smirnov statistics were used to compare the length distributions of each release group taken in these samples to the original distribution at time of release (Figure 4). These tests showed significant differences for all of the gill net samples (Table 2b), but only for adipose finclipped fish taken in the fyke net gear (Table 2c). A comparison of the length distributions of the three release groups within each gear type (Figure 5) showed no difference between the groups for the fyke net gear in June or October, but there was a significant difference for the gill net gear (Table 2d). The tests comparing length distributions between gears (Figure 4) were significant for adipose and right-ventral finclipped and for unmarked rainbow trout (Table 2e). The results of these tests comparing length distributions indicate that gill nets were selecting for larger fish, while the fyke net samples were more

Table 2. Results of Kolmogorov-Smirnov tests comparing the length distributions of rainbow trout sampled in Big Lake, 1988.

Comparison	Kolmogorov-Smirnov Statistic	P-value[1]
a) Between mark groups at release:		
	0.11	0.04
b) Between gill net samples in June amd mark groups at release for:		
Adipose fin clips	0.19	0.03
Left ventral	0.13	0.08
Right ventral	0.26	0.005
c) Between fyke net samples in June amd mark groups at release for:		
Adipose fin clips	0.10	0.04
Left ventral	0.04	0.90
Right ventral	0.12	0.12
d) Between release groups for:		
Gill net in June	4.56	<0.01
Fyke net in June	0.23	>0.25
Fyke net in October	0.97	>0.10
e) Between gears in June for:		
Adipose finclips	2.04	<0.01
Left ventral	1.08	0.19
Right ventral	2.09	<0.01
Unmarked	5.20	<0.01

[1] Test significant at $P < 0.10$.

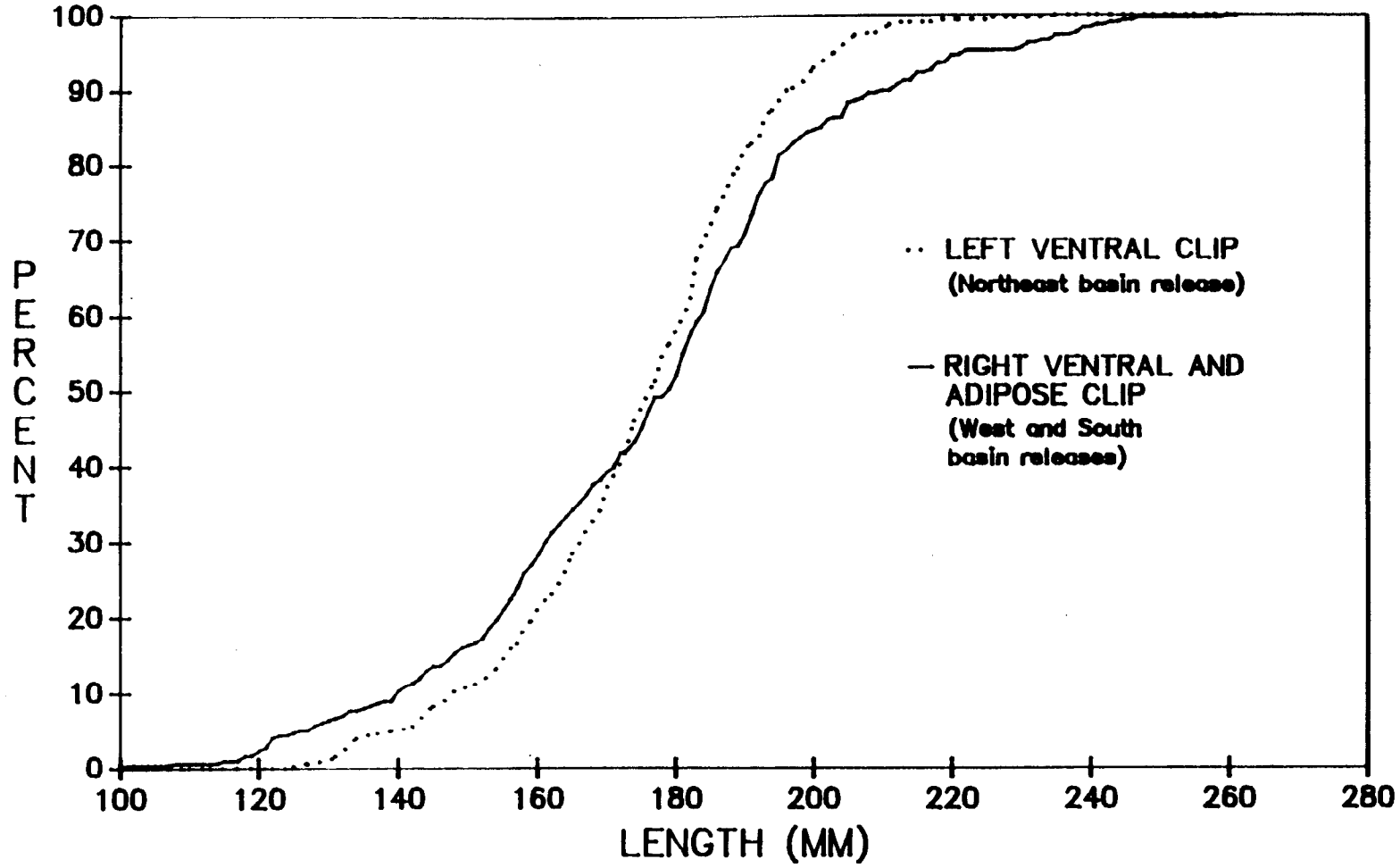

Figure 3. Cumulative length distribution at release of rainbow trout stocked in Big Lake, 1988.

Table 3. Catch and effort for stocked rainbow trout, wild rainbow trout, and Arctic char by gear type during the abundance estimate in Big Lake's basins 1 through 7, and Mirror and Flat Lakes, 20 June to 28 June 1988.

				Number Captured						
				Stocked Rainbow Trout					Rainbow Trout Composition	
Basin	Capture Method[1]	Number Traps	Trap Hours	LV	AD	RV	Total	Wild Rainbow Trout	Stocked:Wild	Arctic Char
1	FN	20	415.0	72	41	16	129	123	51% : 49%	0
	GN	15	68.0	49	6	10	65	16	80% : 20%	21
			Totals	121	47	26	194	139	58% : 42%	21
2	FN	20	460.0	90	23	17	130	53	71% : 29%	0
	GN	15	44.8	67	13	11	91	39	70% : 30%	9
			Totals	157	36	28	221	92	71% : 29%	9
3	FN	22	495.5	75	89	45	209	79	73% : 27%	0
	GN	15	43.8	17	20	11	48	9	84% : 16%	14
			Totals	92	109	56	257	88	74% : 26%	14
4	FN	22	500.5	44	95	99	238	76	76% : 24%	0
	GN	15	59.5	5	6	5	16	10	62% : 38%	7
			Totals	49	101	104	254	86	75% : 25%	7
5	FN	22	464.8	5	116	22	143	57	72% : 28%	0
	GN	15	46.3	5	3	20	28	6	82% : 18%	10
			Totals	10	119	42	171	63	73% : 27%	10
6	FN	22	514.3	22	29	41	92	32	74% : 26%	0
	GN	15	46.8	6	3	0	9	10	47% : 53%	4
			Totals	28	32	41	101	42	71% : 29%	4
7	FN	15	335.3	13	22	45	80	27	75% : 25%	0
	GN	8	31.5	0	0	0	0	0		2
			Totals	13	22	45	80	27	75% : 25%	2
Mirror	FN	7	157.5	9	20	76	105	32	77% : 23%	0
	GN	7	10.8	0	0	0	0	0		2
			Totals	9	20	76	105	32	77% : 23%	2

-Continued-

Table 3. Catch and effort for stocked rainbow trout, wild rainbow trout, and Arctic char by gear type during the abundance estimate in Big Lake's basins 1 through 7, and Mirror and Flat Lakes, 20 June to 28 June 1988 (continued).

				Number Captured						
				Stocked Rainbow Trout					Rainbow Trout Composition	
Basin	Capture Method[1]	Number Traps	Trap Hours	LV	AD	RV	Total	Wild Rainbow Trout	Stocked:Wild	Arctic Char
Flat	FN	22	486.8	10	32	134	176	23	88% : 12%	0
	GN	15	52.0	0	1	14	15	4	79% : 21%	1
			Totals	10	33	148	191	27	86% : 14%	1
Totals	FN		3,829.7	340	467	495	1,302	502	72% : 28%	0
	GN		436.7	149	52	71	272	94	74% : 26%	70
			Totals	489	519	566	1,574	596	73% : 27%	70

[1] GN = Gillnet, FN = Fyke Net.

Table 4. Catch and effort for stocked rainbow trout, wild rainbow trout, and Arctic char by gear type during sampling in Big Lake's basins 1, 4, and 7, 14 October to 23 October 1988.

				Number Captured			
Basin	Capture Method[1]	Number Traps	Trap Hours	Stocked Rainbow Trout	Wild Rainbow Trout	Rainbow Trout Composition Stocked:Wild	Arctic Char
1	FN	17	327.5	54	62	47% : 53%	0
4	FN	17	384.8	50	56	47% : 53%	1
7	FN	17	379.0	51	80	39% : 61%	1
		Totals	1,091.3	155	198	44% : 56%	2

[1] FN = Fyke Net.

Table 5. Summary of length (mm) and CPUE by basin for rainbow trout (RT) and Arctic char in Big, Mirror, and Flat Lakes, June 1988.

Basin	Species	Capture Method[1]	Number Caught	Catch		Length		
				Per Net Hour	SE	Mean	SE	Range
1	Stocked RT	FN	129	0.311	0.5446	176	2	119 - 228
		GN	65	0.957	0.6407	185	3	124 - 250
	Wild RT	FN	123	0.296	0.0445	161	3	88 - 265
		GN	16	0.235	0.1356	212	15	118 - 292
	Arctic Char	FN	0					
		GN	21	0.309	0.1015	454	17	226 - 584
2	Stocked RT	FN	130	0.283	0.0916	169	2	108 - 217
		GN	91	2.036	1.0385	177	2	130 - 265
	Wild RT	FN	53	0.115	0.0211	171	5	93 - 303
		GN	39	0.873	0.3924	239	10	142 - 360
	Arctic Char	FN	0					
		GN	9	0.201	0.0762	436	29	278 - 535
3	Stocked RT	FN	209	0.422	0.1075	174	2	125 - 280
		GN	48	1.096	0.5858	180	3	129 - 234
	Wild RT	FN	79	0.160	0.0296	163	3	102 - 235
		GN	9	0.206	0.1542	266	23	175 - 433
	Arctic Char	FN	0					
		GN	14	0.3196	0.1564	374	18	300 - 510
4	Stocked RT	FN	238	0.476	0.1230	173	1	123 - 240
		GN	16	0.269	0.1820	211	5	181 - 254
	Wild RT	FN	76	0.152	0.0279	169	4	87 - 298
		GN	10	0.168	0.0912	254	16	185 - 330
	Arctic Char	FN	0					
		GN	7	0.118	0.0468	395	39	274 - 515

-Continued-

Table 5. Summary of length (mm) and CPUE by basin for rainbow trout (RT) and Arctic char in Big, Mirror, and Flat Lakes, June 1988 (continued).

Basin	Species	Capture Method[1]	Number Caught	Catch		Length		
				Per Net Hour	SE	Mean	SE	Range
5	Stocked RT	FN	143	0.308	0.1424	171	2	116 - 227
		GN	28	0.604	0.3125	181	5	134 - 257
	Wild RT	FN	57	0.123	0.0247	174	4	105 - 262
		GN	6	0.129	0.0595	242	20	202 - 319
	Arctic Char	FN	0					
		GN	10	0.216	0.0659	436	34	281 - 645
6	Stocked RT	FN	92	0.179	0.0439	181	2	118 - 234
		GN	9	0.192	0.1443	185	3	173 - 203
	Wild RT	FN	32	0.062	0.0131	170	6	110 - 239
		GN	10	0.214	0.1340	232	17	158 - 340
	Arctic Char	FN	0					
		GN	4	0.086	0.0475	436	71	189 - 532
7	Stocked RT	FN	80	0.239	0.0918	176	3	120 - 223
		GN	0					
	Wild RT	FN	27	0.081	0.0208	167	8	102 - 269
		GN	0					
	Arctic Char	FN	0					
		GN	2	0.064	0.0600	479	34	431 - 527
Mirror	Stocked RT	FN	105	0.667	0.2540	170	2	123 - 225
		GN	0					
	Wild RT	FN	32	0.203	0.0482	172	7	105 - 293
		GN	0					
	Arctic Char	FN	0					
		GN	2	0.186	0.1109	390	71	289 - 490

-Continued-

Table 5. Summary of length (mm) and CPUE by basin for rainbow trout (RT) and Arctic char in Big, Mirror, and Flat Lakes, June 1988 (continued).

Basin	Species	Capture Method[1]	Number Caught	Catch		Length		
				Per Net Hour	SE	Mean	SE	Range
Flat	Stocked RT	FN	176	0.362	0.0822	181	1	122 - 227
		GN	15	0.288	0.1761	189	6	138 - 227
	Wild RT	FN	23	0.047	0.0107	179	10	79 - 307
		GN	4	0.077	0.0329	261	28	196 - 350
	Arctic Char	FN	0					
		GN	1	0.192	0.0186	453		
TOTALS:								
	Stocked RT	FN	1,302	0.340	0.0383	174	1	108 - 280
		GN	272	0.680	0.1871	183	1	124 - 265
	Wild RT	FN	502	0.133	0.0106	167	2	79 - 307
		GN	94	0.238	0.0641	239	6	118 - 433
	Arctic Char	FN	0					
		GN	70	0.174	0.0301	425	11	189 - 645

[1] FN = Fyke net; GN = Gill net.

Table 6. Summary of length (mm) and CPUE by basin for rainbow trout (RT) and Arctic char in Big Lake's basins 1, 4, and 7, October 1988.

Basin	Species	Capture Method[1]	Number Caught	Catch		Length		
				Per Net Hour	SE	Mean	SE	Range
1	Stocked RT	FN	54	0.165	0.0495	234	3	190 - 284
	Wild RT	FN	62	0.189	0.0500	233	6	118 - 390
	Arctic Char	FN	0					
4	Stocked RT	FN	50	0.130	0.0256	245	3	179 - 281
	Wild RT	FN	56	0.146	0.0296	246	9	133 - 420
	Arctic Char	FN	1	0.003	0.0025	176		
7	Stocked RT	FN	51	0.135	0.0299	241	4	181 - 312
	Wild RT	FN	80	0.211	0.0515	223	8	124 - 465
	Arctic Char	FN	1	0.003	0.0026	224		
TOTALS:								
	Stocked RT	FN	155	0.143	0.0214	240	2	179 - 312
	Wild RT	FN	198	0.182	0.0264	233	4	118 - 465
	Arctic Char	FN	2	0.002	0.0012	200	24	176 - 224

[1] FN = Fyke net.

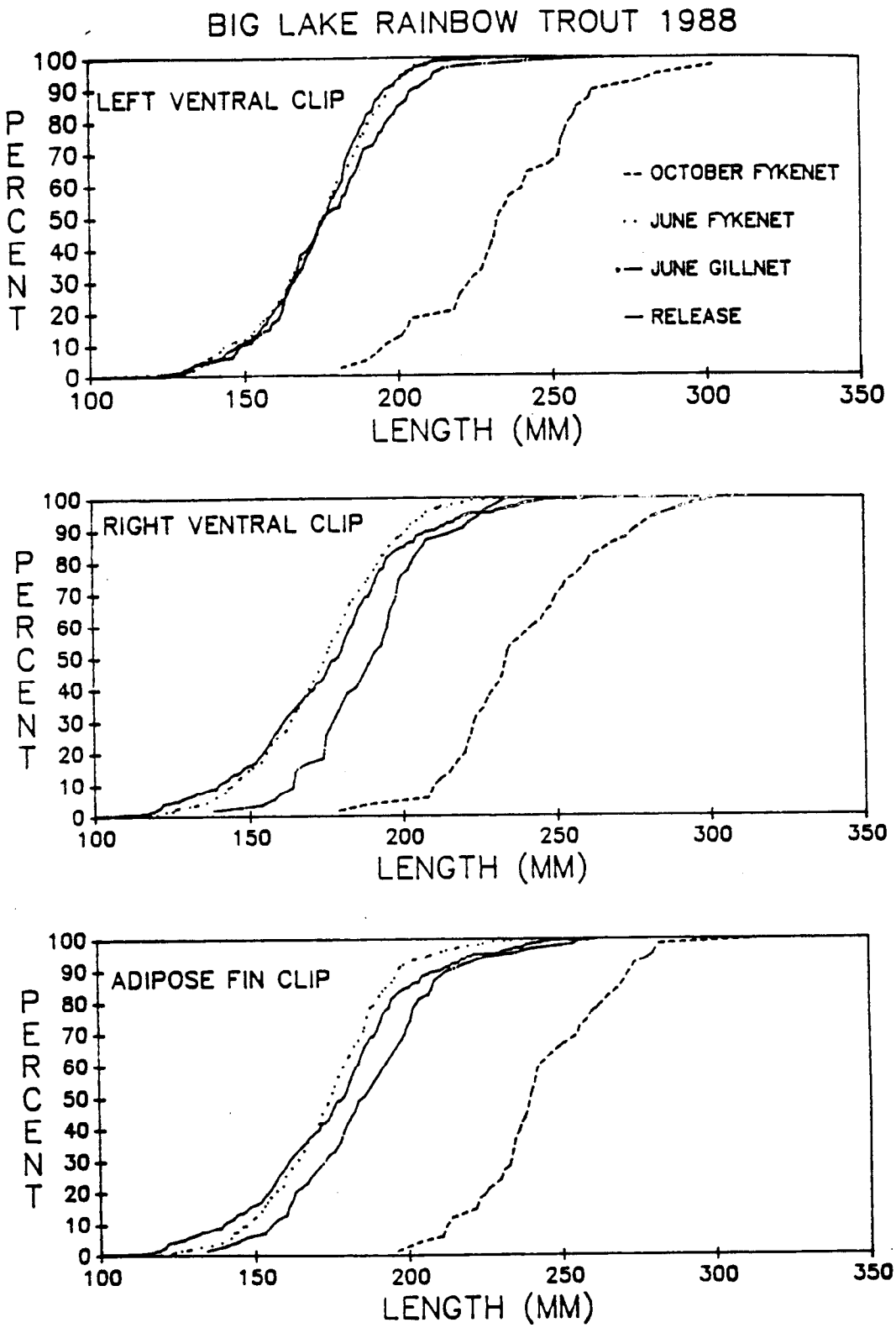

Figure 4. Cumulative length distributions by type of clip of rainbow trout taken in fyke nets and gill nets in Big Lake in June and October 1988.

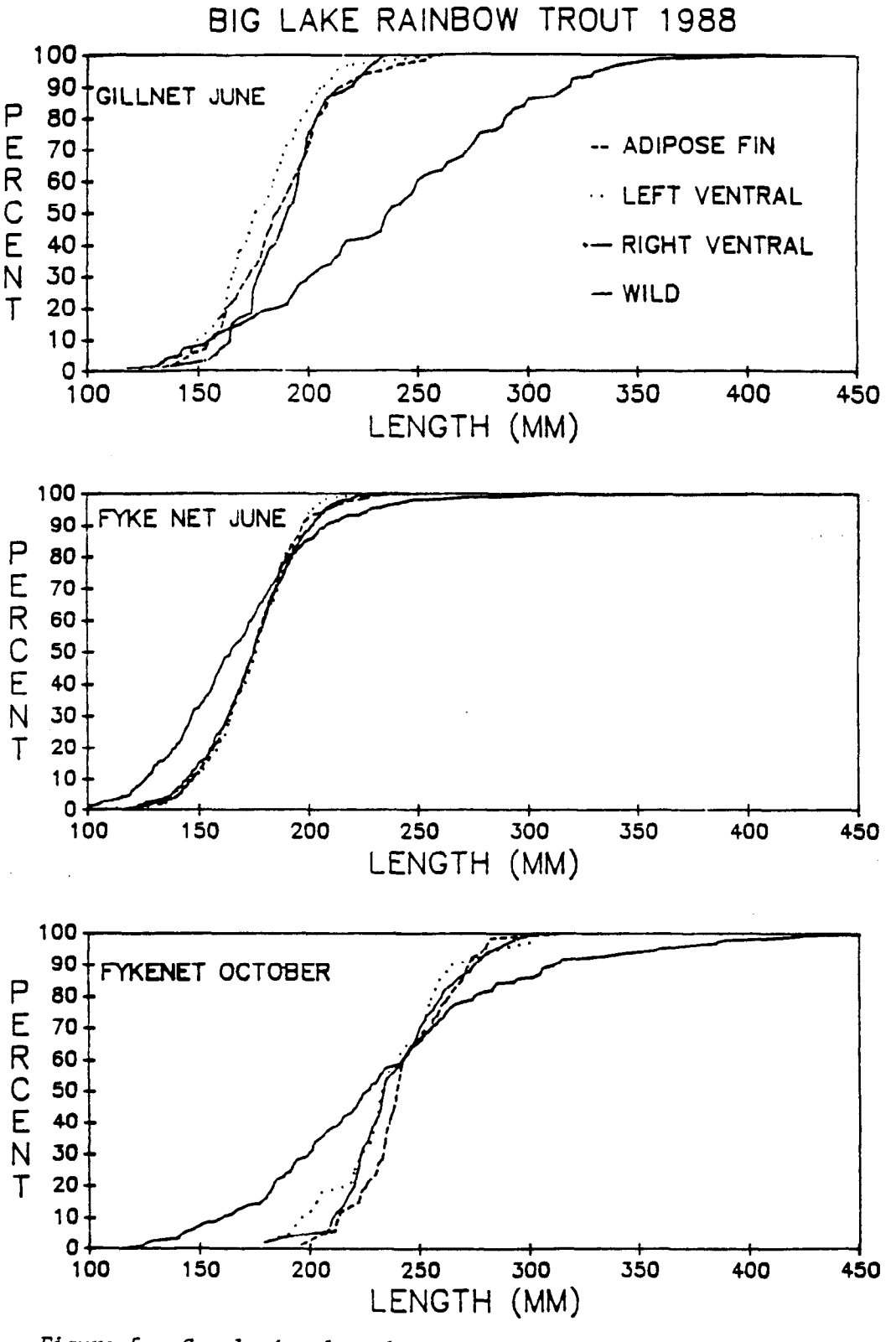

Figure 5. Cumulative length distributions for stocked and wild rainbow trout taken in gill nets and fyke nets in June and fyke nets in October 1988.

representative of the released groups. Therefore, the gill net samples were not included in the recovery samples for the purpose of estimating population abundances.

Stratification

The rainbow trout were released in three locations and all three release groups were recovered throughout the lake (Appendix Table 2). A comparison of marked to unmarked ratios suggests that movement from time of release to the June sampling was oriented along the shoreline. Adipose finclipped fish were released on the southern shore of basin 4 and ratios of marked-to-unmarked for adipose finclipped trout were significantly higher along the southern shorelines of basins 3 and 4 compared to the northern shoreline just opposite the release site for adipose finclipped fish. The left-ventral clipped fish were released in basin 2 and appeared to migrate to the north shore of basin 3 faster than to the south shore. The ratio for left ventral finclipped fish was higher along the northern shoreline of basin 3 (Table 7).

The release and recovery data were stratified to test the assumption of equal capture probabilities. The three release groups, or different finclips, represent the release strata. The lake was divided into three geographical recovery strata which were defined by the location of release with the assumption that movement would tend to occur along the shoreline. The first stratum covers the east end of the lake where the fish with left ventral finclips were released, the second the southern shore where adipose finclipped trout were released and the third the western end and northwest shore where the trout with right ventral finclips were released (Figure 2).

Both of the test statistics comparing the rate of recovery and the marked-to-unmarked ratios were significant for the June samples indicating that in the 3 weeks after release, stocked rainbow trout had not migrated throughout all areas of the lake. The assumption of equal catchability for all individuals in June could not be met. However, for the October sampling, neither statistic was significant (Table 8). The stratified Petersen estimator (Darroch 1961) was therefore used for estimating abundance from the June sampling period and the Chapman modification to the Petersen was used for the October recovery sample.

Growth Recruitment

The average number of unmarked to marked in the October sample (V_i) shows significant differences from the expected for lengths under 200 mm (Table 9, Figure 6). These averages stabilize at about two unmarked to marked for lengths between 200 mm and 240 mm (Figure 6). The marked to unmarked ratios for rainbow trout over 200 mm was 0.93, while only 0.12 marked trout were sampled for every unmarked trout under 200 mm. The marked to unmarked ratio for the size classes over 200 mm was used in the estimate of the abundance of rainbow trout in Big Lake for October of 1988. The increase in V_i for the larger size classes (Figure 6) is due to the presence of large wild trout, while the trout stocked all fall within a narrow range of lengths.

Table 7. Marked to unmarked ratios of rainbow trout for separate shores of Big Lake, 1988, with results of χ^2-tests comparing ratios between shores.

Basin	Shore	Adipose	Left ventral	Right Ventral
3	North	0.769	1.135	0.577
	South	1.613	0.516	0.484
	Significance	P<0.05	P<0.05	ns
4	North	0.871	0.629	1.429
	South	2.530	0.294	0.529
	Significance	P<0.005	ns	ns
8	North	1.118	0.941	1.412
	West	0.687	0.437	1.125
	Significance	ns	ns	ns

Table 8. Results of tests comparing the rate of recovery of rainbow trout by release group and the ratio of marked to unmarked by recovery strata in Big Lake, 1988.

A. Rate of recovery by release group:

Recovery Period	Fate	Release group[2] LV	AD	RV	
June 1988	Recovered	342	273	498	T-statistic[1] = 32.58
	Not recovered	7,680	7,535	7,505	$P < 0.005$
October 1988	Recovered	39	56	50	T-statistic = 2.95
	Not recovered	7,833	7,883	7,899	not significant

B. Ratio of unmarked to marked by recovery strata.

Recovery Period		Recovery strata 1	2	3	
June 1988	Marked	388	281	644	$\chi^2 = 40.92$,
	Unmarked	231	106	182	$P < 0.005$
October 1988	Marked	54	23	78	$\chi^2 = 1.34$
	Unmarked	62	24	111	not significant

[1] Test described by Seber (1982), p. 438.
[2] LV = left ventral fin clip, AD = adipose fin clip, RV = right ventral fin clip.

Table 9. Application of the nonparametric test described by Robson and Flick (1965) for growth recruitment.[1]

							Logarithms of Factorials of the Expressions Below					
L(i)	C(i)	M	C	C+M-C(i)	C-C(i)	C+M	C	C+M-C(i)	C-C(i)	C+M	P[C>C(i)]	k
178	30	76	197	243	167	273	847.35	1095.48	691.18	1262.11	0.00	0
179	0	76	167	243	167	243	691.18	1095.48	691.18	1095.48	1.00	1
181	5	75	167	237	162	242	691.18	1062.58	665.65	1089.99	0.15	1
189	13	74	162	223	149	236	665.65	986.42	600.01	1057.12	0.01 *	1
190	0	73	149	222	149	222	600.01	981.01	600.01	981.01	1.00	1
193	6	72	149	215	143	221	600.01	943.29	570.09	975.61	0.09 *	1
196	2	71	143	212	141	214	570.09	927.19	560.17	937.92	0.45	2
201	6	70	141	205	135	211	560.17	889.80	530.58	921.84	0.09 *	1
203	6	69	135	198	129	204	530.58	852.64	501.26	884.47	0.08 *	1
204	1	68	129	196	128	197	501.26	842.07	496.40	847.35	0.65	3
208	5	67	128	190	123	195	496.40	810.48	472.22	836.79	0.12	1
209	0	66	123	189	123	189	472.22	805.23	472.22	805.23	1.00	1
210	2	65	123	186	121	188	472.22	789.52	462.61	799.99	0.43	1
211	0	64	121	185	121	185	462.61	784.29	462.61	784.29	1.00	1
212	1	63	121	183	120	184	462.61	773.86	457.81	779.07	0.66	3
214	3	62	120	179	117	182	457.81	753.05	443.47	768.65	0.28	2
215	3	61	117	175	114	178	443.47	732.34	429.21	747.87	0.28	1
218	2	60	114	172	112	174	429.21	716.86	419.75	727.17	0.43	4
219	1	59	112	170	111	171	419.75	706.57	415.03	711.71	0.65	1
220	2	58	111	167	109	169	415.03	691.18	405.62	701.44	0.43	2
222	4	57	109	162	105	166	405.62	665.65	386.91	686.06	0.18	6
223	2	56	105	159	103	161	386.91	650.41	377.61	660.57	0.42	4
224	3	55	103	155	100	158	377.61	630.17	363.74	645.34	0.27	2
225	0	54	100	154	100	154	363.74	625.13	363.74	625.13	1.00	1
226	2	53	100	151	98	153	363.74	610.04	354.54	620.09	0.43	2
227	1	52	98	149	97	150	354.54	600.01	349.95	605.02	0.65	1
228	3	51	97	145	94	148	349.95	580.03	336.26	595.00	0.28	2
230	1	50	94	143	93	144	336.26	570.09	331.72	575.06	0.65	5

[1] L(i) is the ith length in M+1, ordered, unique lengths from the marking sample, C(i) is the number of lengths from the second sample that fall between L(i) and L(i-1), C is the catch during the second sample, and k is the number of repititions for each unique length from the first sample. P[C > C(i)] is the Probability of a Type I error when k=1 and is the minimum Probability of a Type I error when k > 1.

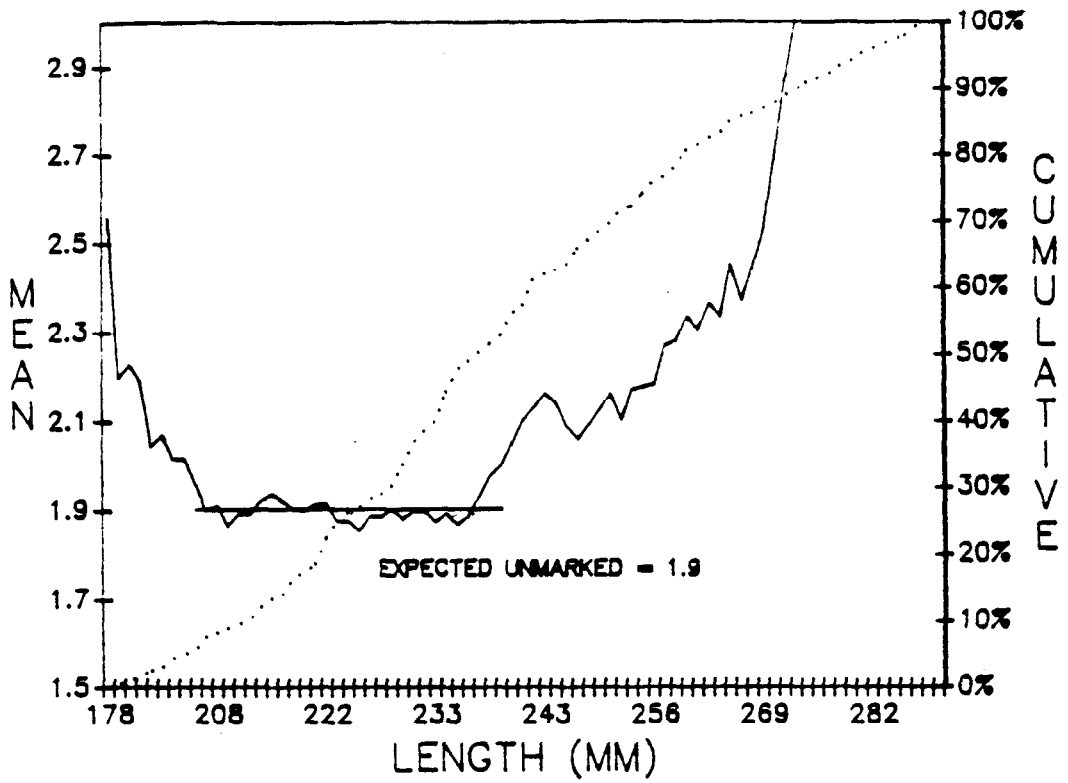

Figure 6. Mean number of unmarked rainbow trout per marked trout and cumulative length distribution for trout in October sampling in Big Lake, 1988.

Abundance Estimates

Abundance of unmarked or wild rainbow trout at the time of hatchery release was estimated twice, first using the June sampling as the recapture event and second using the October sampling as the recapture event. The estimate from the June sampling was 10,607 fish with a standard error of 627 fish (Table 10). The estimate from the October sampling was 46,294 trout, with a standard error of 2,613 fish (Table 10). The unadjusted estimate for October (i.e. recruits not deleted) was 54,385 fish, so 9,090 fish were removed from the abundance estimate when the data were corrected for recruitment. The total abundance of unmarked trout from the October sampling was therefore estimated at 22,261 trout with a standard error of 2,613 fish.

Examination of Harvested Fish

Over the period from June of 1988 to April of 1989, a total of 142 wild trout and 99 stocked trout were examined from the sport fishery (Table 11). The relative contribution of stocked fish increased from the summer to the winter fishery. From this, we conclude that stocked fish were not differentially harvested between the time of stocking and recapture for the abundance estimate.

Age Composition

Otoliths were collected from 313 rainbow trout and 613 Arctic char taken in sample nets or harvested in the Big Lake sport fishery between December 1986 and October 1988. Most of the sampled rainbow trout were age 5 and 6, with the oldest rainbow trout examined being age 12. Most of the Arctic char sampled were age 3, with the oldest Arctic char examined being age 12 (Table 12).

Lake Surveys

No rainbow trout were captured in other lakes of the Big Lake drainage. Stickleback dominated both the fyke net and minnow trap catches during lake surveys in Beaver Tail, Dollar, Little Beaver, Never-Never, Orchid, and Sara Lakes (Table 13). Beaver Tail and Little Beaver Lakes, which contain only stickleback, and Sara Lake which contains stickleback plus a population of Arctic char ranging in length from 257 mm to 360 mm (Table 14), are all currently isolated from Big Lake by low water conditions through swamp drainages. Never-Never Lake, from which two mature Arctic char at 610 mm and 613 mm, several longnose suckers, and 115 age 1 through age 3 rearing coho salmon were captured, probably has an annual connection to Big Lake during high water conditions each spring. Dollar and Orchid Lakes, which have permanent drainages to Big Lake, contained both stickleback and rearing coho salmon.

Table 10. Abundance estimates for Big Lake rainbow trout 1988. Estimates are for abundance at time of release of hatchery trout into Big Lake.

June 1988 sample:

Release Stratum	Total Released	Recovery Stratum East	South	Northwest	Total
Left ventral	8,022	221	26	95	342
Adipose	8,008	104	209	160	473
Right ventral	8,003	63	46	389	498
Unmarked		231	106	182	1,313
Estimated Abundance of Unmarked		6,600	1,386	2,621	10,607
SE		674	280	277	627

October 1988 sample:

	Adjusted for recruitment	Not adjusted
Marked	148	155
Unmarked	138	197
Estimated abundance	46,294	54,385
Estimated unmarked	22,261	30,352
SE	2,613	3,232

Table 11. Numbers of stocked and wild rainbow trout inspected in the Big Lake sport harvest, 1988.

Period	Stocked Harvest	Wild Harvest
Summer (ice-free)		
06/03/88-06/24/88	10	20
07/02/88-07/17/88	12	7
08/06/88-08/20/88	16	30
09/03/88-09/11/88	4	12
10/01/88-10/09/88	11	27
Winter (ice-cover)		
11/11/88-11/28/88	19	20
12/01/88-12/31/88	7	17
01/07/89-01/15/89	10	3
02/11/89-02/19/89	4	4
03/11/89-03/12/89	6	2
04/08/89-04/09/89	0	0
Sub-total (Summer):	53	96
Sub-total (Winter):	46	46
Totals:	99	142

Table 12. Summary of length (mm) by age class (otoliths) for wild rainbow trout and Arctic char samples collected from Big Lake, December 1986 through October 1988.

Species	Age Class	Number Examined	Length		
			Mean	SE	Range
Rainbow Trout	1	0			
	2	5	95	5	83 - 108
	3	11	138	7	113 - 182
	4	39	175	5	132 - 221
	5	71	219	4	132 - 319
	6	72	264	4	140 - 371
	7	50	300	5	225 - 395
	8	36	358	6	291 - 460
	9	19	413	6	372 - 465
	10	6	419	14	383 - 473
	11	2	486	1	486 - 487
	12	2	461	19	442 - 480
Arctic Char	1	4	131	8	115 - 156
	2	23	177	5	144 - 251
	3	142	229	3	156 - 325
	4	113	293	4	200 - 370
	5	84	348	5	258 - 455
	6	69	420	6	302 - 515
	7	62	473	3	420 - 530
	8	63	508	3	445 - 565
	9	37	535	6	470 - 628
	10	12	577	13	520 - 670
	11	3	579	26	535 - 624
	12	1	652		

Table 13. Catch and effort by gear type during surveys of Beaver Tail, Dollar, Little Beaver, Never-Never, Orchid, and Sara Lakes, 18 July through 24 August 1988.

Lake	Sample Date	Surface Area (ha)	Capture Method[1]	Number of Traps	Number of Hours	Number of Fish Captured: Rainbow Trout	Arctic Char	Coho[2] Salmon	Long nose Sucker	Three spine Stickleback
Beaver Tail	07/18/88	10.8	MT	10	215.0	0	0	0	0	60
			FN	1	21.0	0	0	0	0	1,000
			GN	1	21.5	0	0	0	0	0
					TOTALS:	0	0	0	0	1,060
Dollar	07/21/88	2.3	MT	10	225.0	0	0	0	0	300
			FN	1	23.5	0	0	0	0	2,000
			GN	1	22.5	0	0	18	0	0
					TOTALS:	0	0	18	0	2,300
Little Beaver	07/18/88	18.0	MT	10	210.0	0	0	0	0	200
			FN	1	24.0	0	0	0	0	2,000
			GN	2	48.0	0	0	0	0	0
					TOTALS:	0	0	0	0	2,200
Never-Never	08/24/88	12.5	MT	9	211.0	0	0	0	0	220
			FN	2	48.0	0	0	88	20	600
			GN	2	47.5	0	2	27	11	0
					TOTALS:	0	2	115	31	820
Orchid	07/26/88	7.6	MT	10	235.0	0	0	2	0	305
			FN	1	22.5	0	0	153	0	2,000
			GN	1	22.5	0	0	80	0	0
					TOTALS:	0	0	233	0	2,305
Sara[3]	08/24/88	17.79	MT	10	215.0	0	0	0	0	330
			FN	2	47.0	0	1	0	0	1,050
			GN	2	48.0	0	15	0	0	0
					TOTALS:	0	16	0	0	1,385

[1] MT = Minnow Trap, FN = Fyke Net, GN = Gillnet

[2] Coho salmon captured were rearing juvenile fish.

[3] Minnow traps and fyke nets captured 590 cottids in Sarah Lake.

Table 14. Summary of length (mm) and CPUE data for Arctic char (AC) captured during surveys of Never-Never and Sara Lakes, 24 August 1988.

Lake	Sample Date	Species	Capture Method[1]	Number Caught	Catch/ Net Hour	Number Measured	Length		
							Mean	SE	Range
Never-Never	08/24/88	AC	GN	2	0.04	2	612	2	610 - 613
Sara	08/24/88	AC	FN	1	0.02	1	308		
			GN	15	0.31	15	296	8	257 - 360

[1] FN = Fyke Net; GN = Gillnet.

DISCUSSION

Rainbow Trout Abundance Estimation

The June 1988 sampling began 19 days after 24,033 hatchery trout were stocked, and the stocked trout were not randomly mixed with the wild trout. By October 1988, the stocked trout appeared to be randomly mixed with wild trout throughout Big Lake. The gear used for sampling only sampled shoreline areas and so any trout which remained in deeper waters would not be vulnerable to this gear. The change in estimated abundance from June to October may therefore have been due to increased onshore and offshore movement in the fall. Thus the June estimate would only represent the abundance of rainbow trout along the shorelines sampled during June, while the October estimate represents the abundance for the entire lake during June at the time of release.

The decrease in marked-to-unmarked ratio could also have been due to other factors. First, marked fish could have suffered higher fishing mortality than unmarked fish. However, the numbers of inspected wild trout are consistently higher than that for stocked trout during the summer months, which would contradict this hypothesis. Also, there could have been additional mortality associated with finclipping. However, finclipping mortality of rainbow trout is primarily associated with fingerlings (Bergstedt 1985). Also, the results of the chi-square analyses for the release groups and recovery strata (Table 8) both show significant differences in June, but not October. We do not think that these results are consistent with the hypothesis of differential mortality of marked fish due to finclipping as the difference should have persisted into October. As explained previously, they are consistent with differences in migration and mixing with the wild fish between the two sampling periods.

Recommendations

1. The stocking of rainbow trout fingerlings of Big Lake origin initiated in 1987 in lakes tributary to Meadow Creek should be expanded to annual fingerling plants in Big Lake proper.

2. The numbers of harvestable size rainbow trout in Big Lake should continue to be estimated. The population should continue to be partitioned by fish of wild and hatchery origin.

ACKNOWLEDGEMENTS

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APPENDIX

Appendix Table 1. Comparison of length (mm), weight (g), number of pyloric caeca, and total gill rakers between Arctic char sampled at Big Lake in 1987 and at Never-Never and Sarah Lakes in 1988, and Dolly Varden char at Eklutna Lake, 1987.

Location and Species[1]	Number Examined[2]	Length			Weight			Pyloric Caeca			Total Gill Rakers[3]		
		Mean	SE	Range	Mean	SE	Range	Mean	SE	Range	Mean	SE	Range
BL (AC)	168	347	9	144-600	592	45	20-2,570	46	1	35-57			
	73	342	14	168-579	560	65	42-2,385	47	1	36-57	25	1	19-28
NN (AC)	2	613	21	610-616	2,792	159	2,633-2,951	45	2	43-46	25	1	24-25
SR (AC)	13	300	9	257-360	...	...	...	44	1	39-53	25	1	24-27
EL (DV)	28	201	21	64-468	195	63	2-1,250	22	1	16-32	18	1	16-23

[1] BL (AC) = Big Lake (Arctic char); NN (AC) = Never-Never Lake (Arctic char); SR (AC) = Sarah Lake (Arctic char); EL (DV) = Eklutna Lake (Dolly Varden char).

[2] The 73 Arctic char are that portion of the total 168 Arctic char from Big Lake for which gill rakers were counted.

[3] Total gill raker count is the sum of gill rakers on lower and upper arch.

Appendix Table 2. Numbers of stocked rainbow trout and wild rainbow trout captured by fyke net and gill net during Big Lake abundance estimates, 1988.

			Number of Rainbow Trout Captured																	
			Basin #1		Basin #2		Basin #3		Basin #4		Basin #5		Basin #6		Basin #7		Mirror L		Flat L	
Date (Mo)	Net Type	Net No.	S[1]	W[1]	S[1]	W[1]	S[1]	W[1]	S[1]	W[1]	S[1]	W[1]	S[1]	W[1]	S[1]	W[1]	S[1]	W[1]	S[1]	W[1]
June	Gill	1	1	2	18	2	25	7	2	1	9	2	0	1	0	0	0	0	9	0
		2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		3	0	0	0	0	0	1	0	0	1	2	0	0	0	0	0	0	0	0
		4	0	0	46	16	0	0	0	5	0	1	0	6	0	0	0	0	1	0
		5	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
		6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		7	0	0	9	7	9	1	11	1	6	0	0	0	0	0	0	0	4	0
		8	0	0	0	0	0	0	0	3	0	0	0	0	0	0			0	1
		9	0	0	0	0	0	0	0	0	0	0	0	0					0	0
		10	40	7	4	8	9	0	0	0	0	0	1	0					0	1
		11	0	0	0	0	0	0	0	0	0	0	0	0					1	0
		12	0	0	0	0	0	0	0	0	0	0	0	0					0	1
		13	24	7	13	6	5	0	3	0	12	1	1	3					0	0
		14	0	0	0	0	0	0	0	0	0	0	0	0					0	0
		15	0	0	0	0	0	0	0	0	0	0	7	0					0	0
	Totals		65	16	91	39	48	9	16	10	28	6	9	10	0	0	0	0	15	4

-Continued-

Appendix Table 2. Numbers of stocked rainbow trout and wild rainbow trout captured by fyke net and gill net during Big Lake abundance estimates, 1988 (continued).

			Number of Rainbow Trout Captured																	
			Basin #1		Basin #2		Basin #3		Basin #4		Basin #5		Basin #6		Basin #7		Mirror L		Flat L	
Date (Mo)	Net Type	Net No.	S[1]	W[1]	S[1]	W[1]	S[1]	W[1]	S[1]	W[1]	S[1]	W[1]	S[1]	W[1]	S[1]	W[1]	S[1]	W[1]	S[1]	W[1]
June	Fyke	2	0	4	20	3	3	2	16	5	0	2	4	3	0	3	5	2	19	1
		3	0	0	2	4	2	5	0	2	2	2	12	5	0	1	13	7	1	1
		4	12	3	0	2	18	4	57	10	5	9	0	3	2	2	17	8	20	1
		5	3	9	27	5	32	5	33	7	2	4	0	0	1	0	24	6	29	3
		6	3	4	4	6	14	9	8	8	3	5	14	1	3	1	46	7	4	1
		7	7	14	5	3	2	11	28	5	10	8	0	0	1	0	0	1	3	0
		8	0	7	11	6	0	0	15	10	1	0	15	0	28	4			5	1
		9	48	16	4	4	24	0	0	1	0	0	2	1	13	6			3	0
		10	16	5	0	2	3	7	4	6	67	5	7	2	4	4			12	4
		11	2	4	0	0	32	4	3	2	2	2	1	1	0	1			1	0
		12	1	4	0	2	33	7	1	0	0	0	0	1	10	3			1	2
		13	3	3	5	0	7	3	9	2	6	2	1	3	1	0			0	0
		14	3	7	0	0	5	5	7	0	2	0	0	0	0	2			8	1
		15	2	11	29	5	1	1	7	3	2	1	4	1	0	0			20	2
		16	0	4	2	0	0	1	15	1	22	2	3	1					18	2
		17	0	7	0	0	2	1	1	3	11	4	4	2					5	0
		18	19	7	0	5	1	8	6	1	0	1	6	0					4	2
		19	0	3	0	1	1	2	2	3	5	4	6	4					19	0
		20	10	10	0	0	3	2	8	3	1	3	0	0					3	0
		21					21	2	9	2	1	0	12	3					0	0
		22					5	0	0	0	1	1	0	0					0	2
	Totals		129	123	130	53	209	79	238	76	143	57	92	32	80	27	105	32	176	23

-Continued-

Appendix Table 2. Numbers of stocked rainbow trout and wild rainbow trout captured by fyke net and gill net during Big Lake abundance estimates, 1988 (continued).

			Number of Rainbow Trout Captured															
			Basin #1		Basin #2		Basin #3		Basin #4		Basin #5		Basin #6		Basin #7		Mirror L		Flat L	
Date (Mo)	Net Type	Net No.	S[1]	W[1]	S[1]	W[1]	S[1]	W[1]	S[1]	W[1]	S[1]	W[1]	S[1]	W[1]	S[1]	W[1]	S[1]	W[1]	S[1]	W[1]
Oct	Fyke	1	2	1					5	4					4	13				
		2	3	5					0	1					10	9				
		3	12	7					6	7					4	12				
		4	1	1					2	0					0	0				
		5	5	5					1	2					4	5				
		6	0	0					1	2					2	3				
		7	7	7					5	8					4	2				
		8	1	3					0	0					0	2				
		9	7	13					7	7					0	1				
		10	12	12					0	0					0	0				
		11	2	4					2	5					3	3				
		12	0	1					7	1					2	0				
		13	2	1					0	2					4	1				
		14	0	2					4	2					0	1				
		15	0	0					3	8					8	15				
		16	0	0					2	2					4	7				
		17	0	0					4	5					2	6				
	Totals		54	62					49	56					51	80				

[1]S = Stocked rainbow trout; W = wild rainbow trout.

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